USING WARM MIX ASPHALT ON A PROVINCIAL ROAD PROJECT

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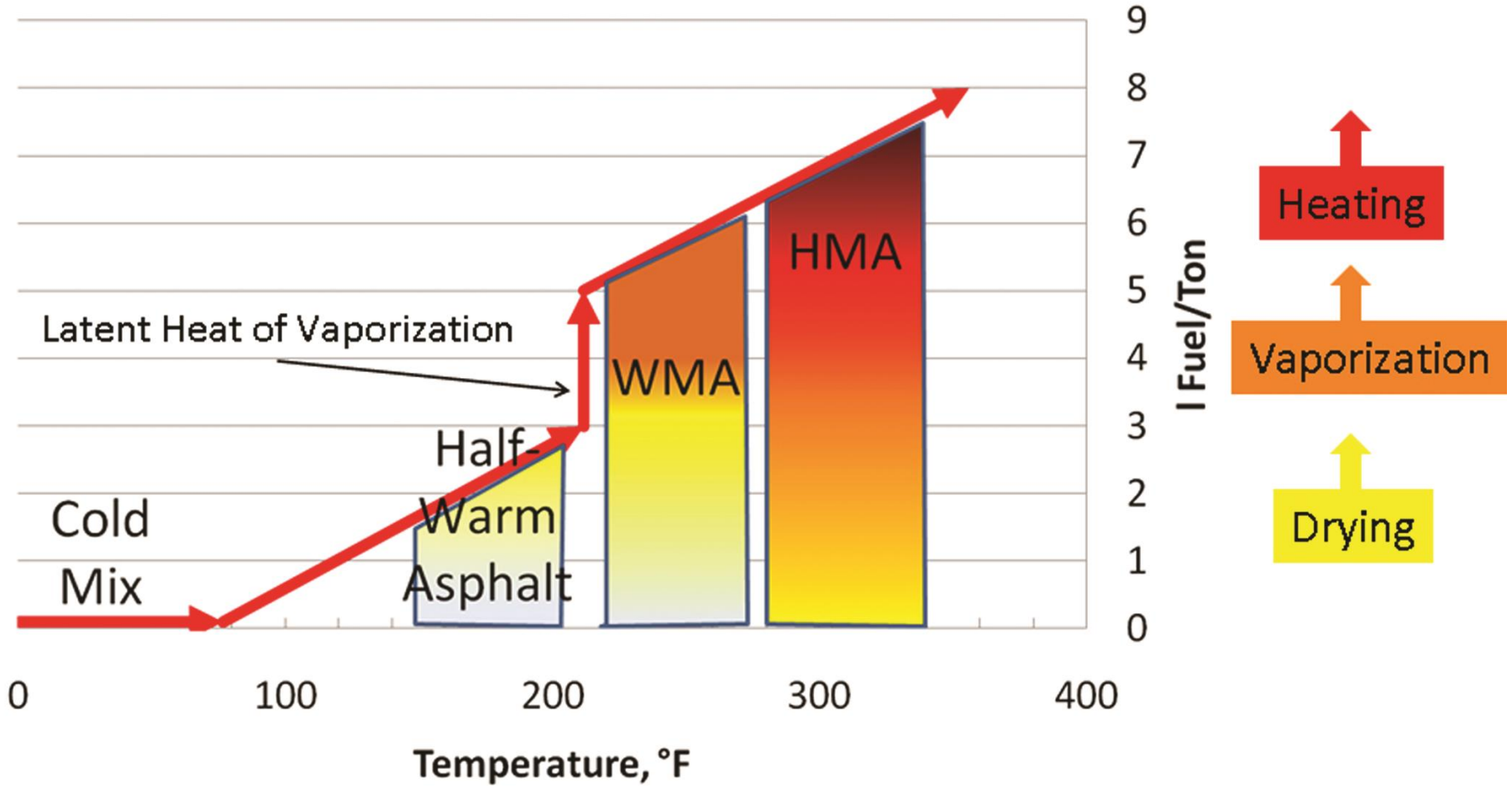
Outline:

- Upgrading Provincial Road P255 to a dual carriageway facility – KZN DoT's first use of Warm Mix Aspalt on a large project
- Approximately 29 000 tons of WMA required
- Asphalt mix contains 25% of reclaimed asphalt (RA)
- Technology of manufacturing and paving asphalt at temperatures at least 20^{o}C below those of conventional asphalt
- Synergy between WMA and reclaimed asphalt
- Benefits of WMA containing reclaimed asphalt

The Concept of WMA



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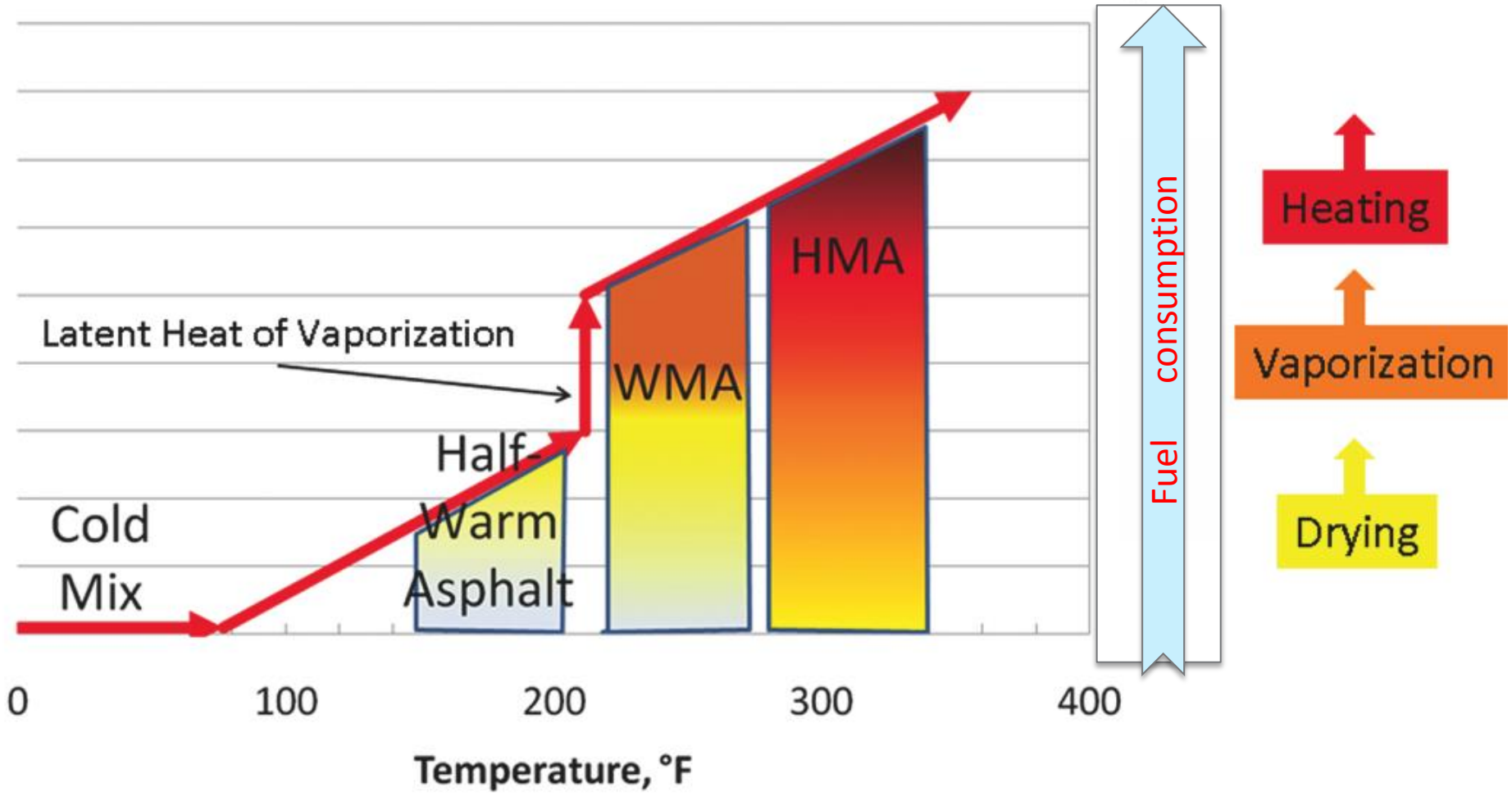
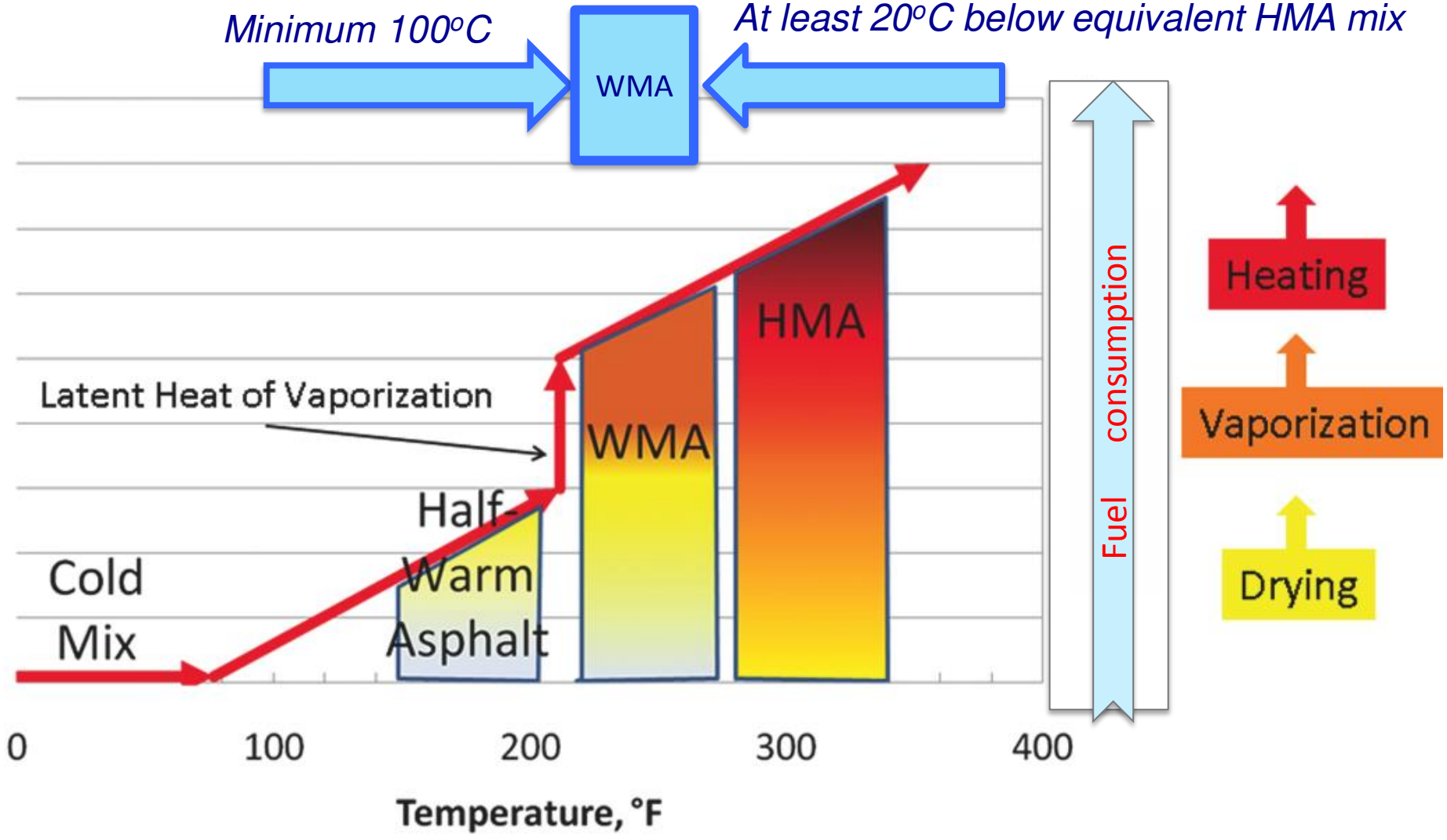



Minimum 100°C
WMA
At least 20°C below equivalent HMA mix
Latent Heat of Vaporization
Cold Mix
Half-Warm Asphalt
WMA
HMA
Fuel consumption
Heating
Vaporization
Drying
0
100
200
300
400
Temperature, °F

Use of WMA in the USA

- Rapid growth in the use of WMA in USA
- 30 states specify WMA
- 26% of all asphalt paved in the USA is WMA

Attributable to:

- Reduction in burner fuel resulting in decreases in greenhouse gases
- Better compaction, reduced roller fuel costs, improved workability
- Longer haulage distances, possible to use asphalt further from plant

South African experience with WMA:

- 2008 First trials on Brackenhill Road
- 2009 Industrial road in Mobeni, Durban
- 2010 Higginson Highway, Chatsworth, Durban

- 2011 Sabita Manual 32 “Best Practice for Warm Mix Asphalt”

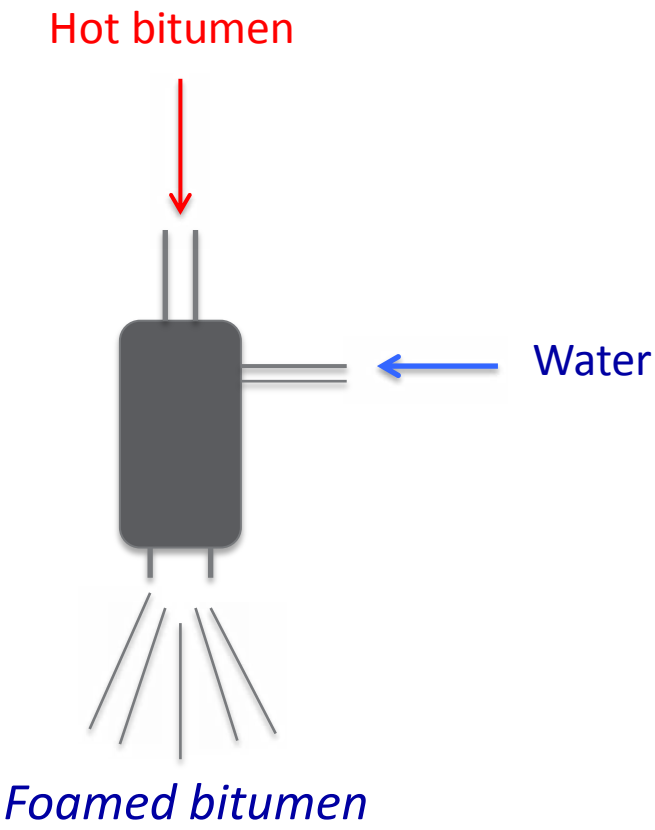
“Mixtures of aggregate, bituminous binder and mineral filler, where a WMA Technology is employed to enable the mix to be manufactured and paved at significantly lower temperatures than hot mixed asphalt, with its quality and performance being equal to, or even exceeding that of hot mixed asphalt”

WMA Technologies:

- Water technologies

- Chemical modifiers
- Rheological modifiers

Basic principles of foamed bitumen

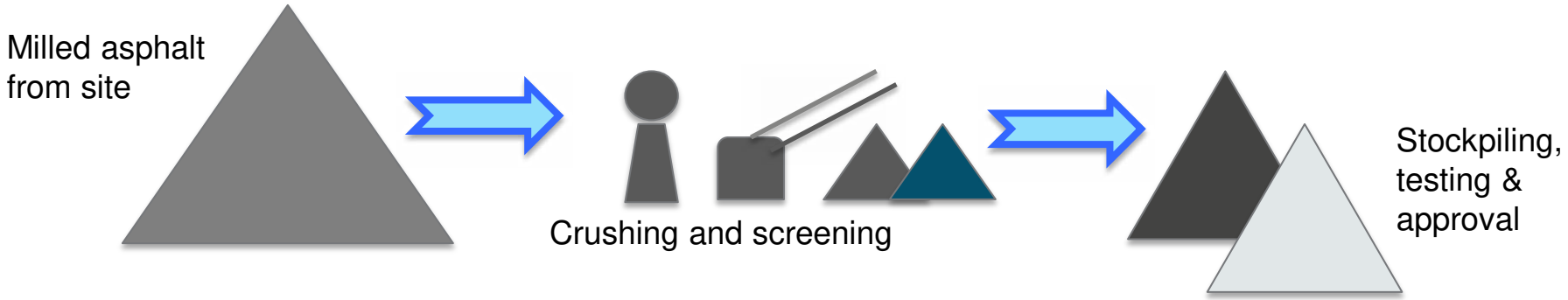


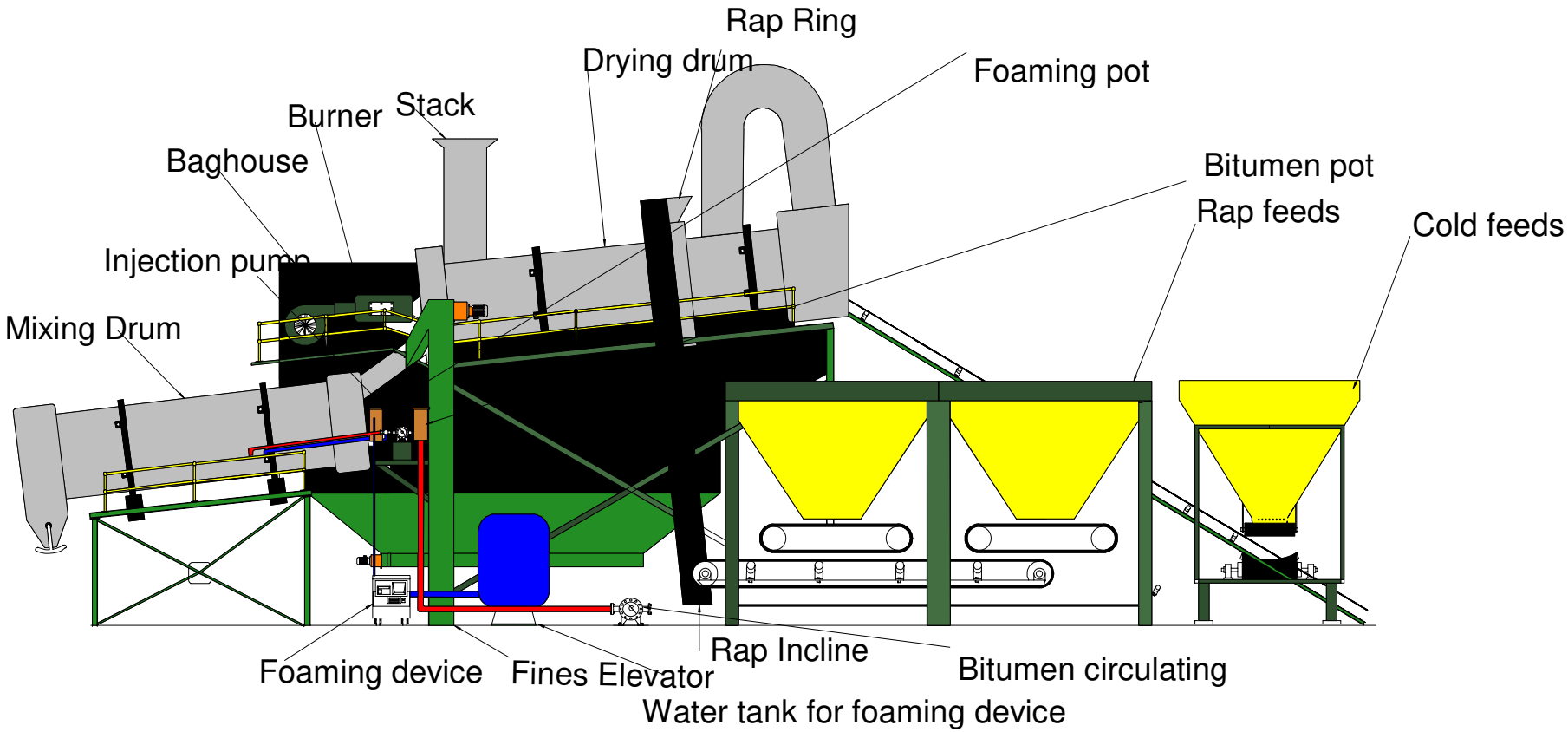
- Reduces viscosity of the bitumen
- Enables aggregate to be coated at lower temperatures
- Improves compaction and workability of the mix

Benefits from inclusion of reclaimed asphalt (RA)

- Extracts highest value – utilises the binder in the RA in the mix
- Reduces quantity of quarried aggregates

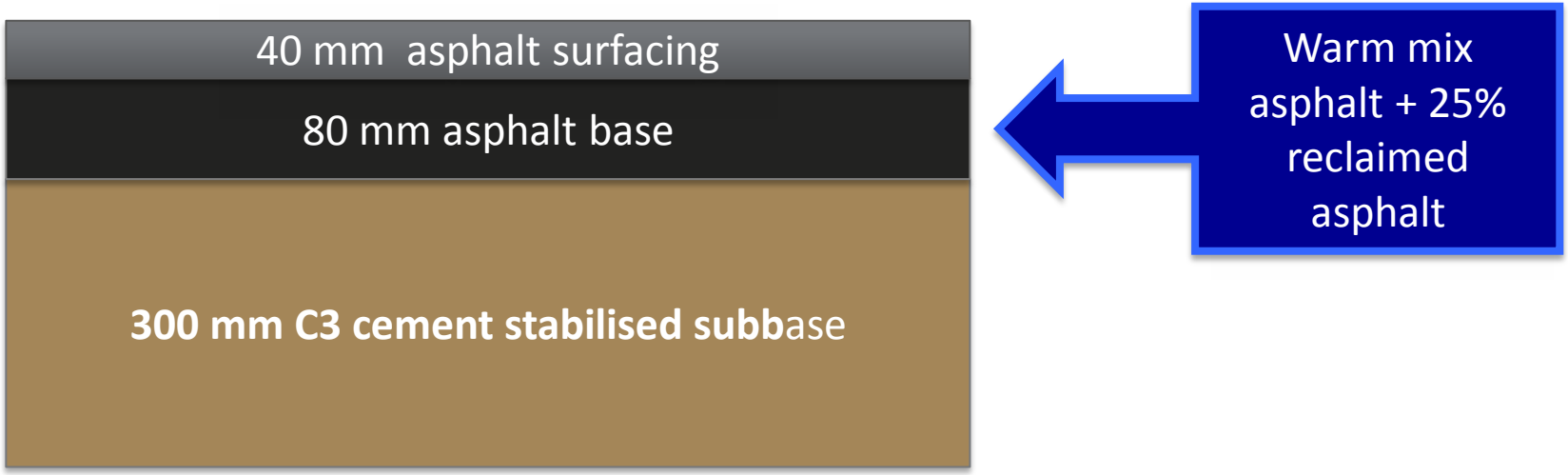
The preparation process

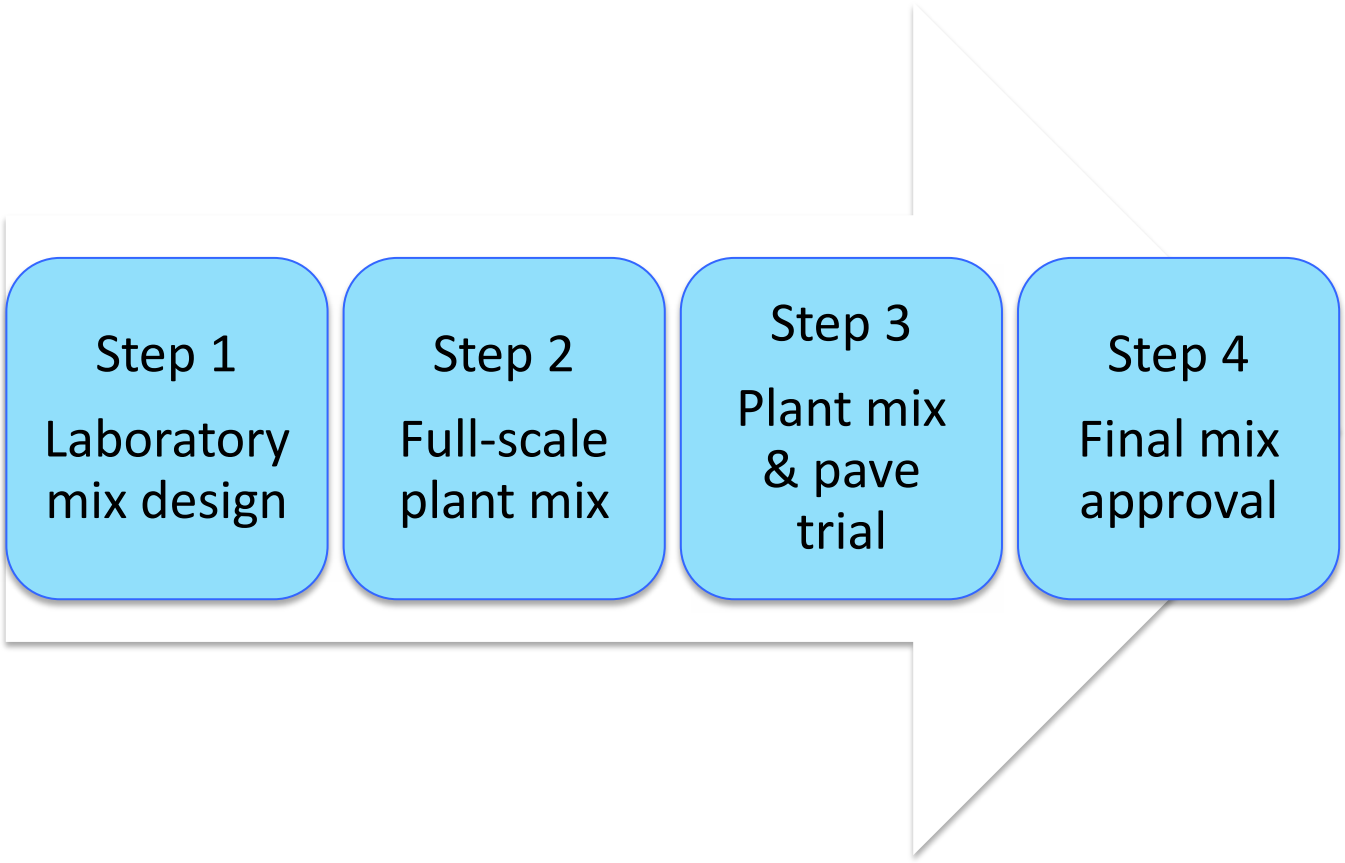



Rap Ring
Drying drum
Foaming pot
Burner
Stack
Baghouse
Bitumen pot
Rap feeds
Cold feeds
Injection pump
Mixing Drum
Foaming device
Fines Elevator
Rap Incline
Bitumen circulating
Water tank for foaming device

RA Conveyor

P255 Pavement Design




Step 1
Laboratory mix design
Step 2
Full-scale plant mix
Step 3
Plant mix & pave trial
Step 4
Final mix approval

Details of the approved mix

Mix proportions:	
19 mm quartzite	22%
13.2 mm quartzite	12%
9.5 mm tillite	8%
Crusher dust tillite	20%
Washed quartzite dust	12%
Minus 20 mm RA	10%
Minus 12 mm RA	15%
Hydrated lime	1%
Manufacturing temperature	130 – 140 ^{o}C
Compaction temperature (Marshall)	105^{o}C
Optimum binder content	4.0%
Air permeability (x10^{-8} cm^{2}) @ 7% void content	0.3
Mod. Lottman TSL	0.92
Gyratory void content after 300 gyrations @ 105^{o}C	3.9%

DYNAPAC
PT 12
CONSTRUCTION VEHICLE

PT 12
DYNAPAC
DYNAPAC
CONSTRUCTION VEHICLE

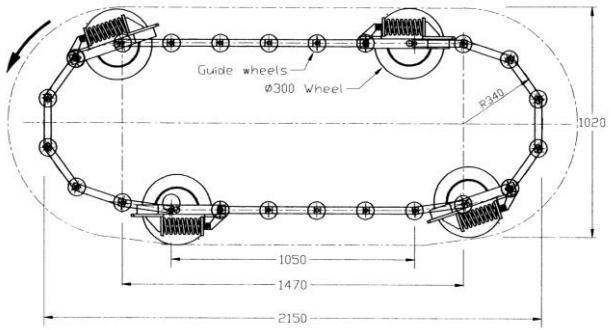
NA
National Asphalt

Summary of typical results

Sieve analysis Sieve size (mm)	Percentage passing	Specification
28	100	100
20	97	87 - 96
14	84	73 - 85
10	70	64 - 79
5	52	43 - 61
2	33	28 - 44
1	23	20 - 35
0.6	18	15 - 30
0.3	13	11 - 24
0.15	8	8 - 19
0.075	5.7	5 - 12
Bitumen content (%)	4.2	3.7 - 4.3
Void content (%)	4.9	3.0 – 6.0
ITS (kPa)	1023	800 min.

Checking rut resistance using the MMLS3

Average void content (%)	6.6
Average rut depth after 100 k repetitions (mm)	1.82



Properties of binder recovered from the mix

Penetration @ 25 °C (1/10 mm)	35
Softening Point (°C)	56.4

Conclusions

- WMA is being used successfully for the first time on a Provincial Road contract in KZN
- A reduction of at least 20^{o}C in manufacturing and paving temperatures is being achieved using the foamed bitumen process
- Adding 25% of RA means that the value of asphalt reclaimed from other nearby Provincial Road projects is maximised; there are both environmental and economic benefits
- Results show that the WMA used on P255 complies with the same standards as that of asphalt manufactured at conventional temperatures
- The results indicate that the binder in the WMA is less aged than that of conventional asphalt mixes, which should improve the longevity of the asphalt layer

From the positive experience gained on this project, its use on other projects is recommended

Thanks for listening!